

# PATENT ABSTRACTS OF JAPAN

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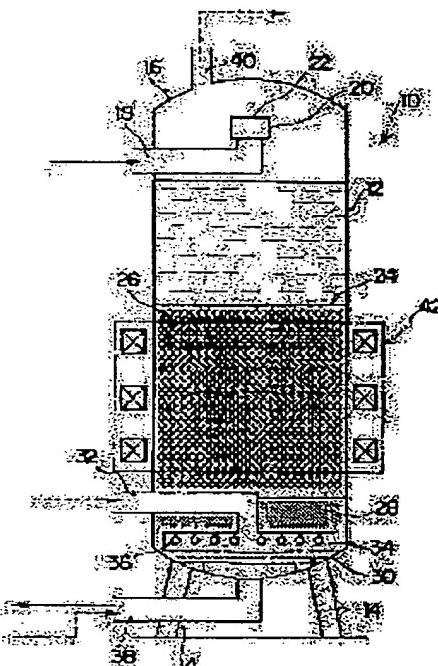
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**(54) HIGH SPEED FILTER AND METHOD OF WASHING FILTER MEDIUM USED THEREFOR**

**(57)Abstract:**

PURPOSE: To wash a fibrous filter medium with high accuracy by installing a filter medium bed densely packed with the fibrous filter medium in the intermediate part of a device main body and installing ultrasonic oscillating means in the prescribed outer periphery part of the device main body corresponding to the outer periphery part of the filter medium bed.

CONSTITUTION: In the prescribed outer periphery part of a device main body 12 corresponding to the outer periphery part of filter medium bed 24, plural ultrasonic oscillators 42 are arranged. When ultrasonic waves are oscillated, the soil stuck on the surface or the like of a fibrous filter medium 26 of the filter medium bed 24 is removed from the fibrous filter medium 26. Then, a compressor is driven to feed air into an air diffusing pipe 34 from an air feed pipe 32 and be jetted to the lower part of the device body 12. As a result, the fibrous filter medium 26 having small specific gravity is agitated with a water current generated by the air, and it is continuously subjected to ultrasonic washing while it is agitated. After that, backward washing water is fed to the lower part of the device body 12 from a drain/backward washing water feed pipe 38. Besides, even at this time, the ultrasonic waves are oscillated.



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**CLAIMS**

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[Claim]

[Claim 1] Tank-like the mainframe of equipment, and the 1st passage which is connected to the upper part of this mainframe of equipment, and supplies non-\*\*\*\*, The filter-medium layer prepared by being arranged at the pars intermedia of the mainframe of equipment, and making it densely filled up with a fiber filter medium, The 2nd passage which conducts water at the time of a back wash while the treated water which was connected to the lower part of the mainframe of equipment, and was filtered by the filter-medium layer is discharged, The high-speed filter characterized by what it is the high-speed filter constituted including the 3rd passage which discharges the back-wash water which conducted water by this 2nd passage to the equipment book outside of the body at the time of a back wash, and the ultrasonic oscillation means was prepared for in the periphery of a filter-medium layer.

[Claim 2] Furthermore, the high-speed filter of the claim 1 publication caudad characterized by what a stirring means to make the fiber filter medium of the aforementioned filter-medium layer which is the component of a filter-medium layer stir was established for by air etc.

[Claim 3] The washing technique of the filter medium used for the high-speed filter characterized by having the 1st process which makes a ultrasonic wave irradiate the filter-medium layer prepared in the tank-like mainframe of equipment by making it densely filled up with a fiber filter medium, and makes dirt exfoliate from a fiber filter medium, and the 2nd process which washes a fiber filter medium by performing aeration and a back wash.

[Claim 4] The 1st process which air etc. is sprayed [ process ] from the lower part of the filter-medium layer prepared in the tank-like mainframe of equipment by making it densely filled up with a fiber filter medium, and makes a fiber filter medium stir, The washing technique of the filter medium used for the high-speed filter characterized by having the 2nd process which makes a ultrasonic wave irradiate the stirred fiber filter medium, and makes dirt exfoliate from a fiber filter medium, and the 3rd process which washes a fiber filter medium by the back wash.

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**DETAILED DESCRIPTION**

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[Detailed description]

[0001]

[Field of the Invention] this invention relates to the washing technique of the filter medium used for a high-speed filter and this.

[0002]

[Prior art] In recent years, installing an artificial pond and an artificial waterfall in sites, such as indoor [ of a building / the vestibule or indoor ], and the works, is widely performed as part of an environmental beautification measure. Since these artificial ponds etc. are usually synizesis drainage systems, a periodical water purification is needed. Since being used for drink does not have water of these synizesis drainage systems and importance had set to beautification of an appearance, in the former, the sand-filtration equipment which used ballast and the sand stratum as a filter medium was purifying.

[0003] Although there is a merit that processing by the low cost is possible for the sand-filtration equipment using this kind of ballast and the sand stratum as a filter medium, in order to be unable to filter and to filter the amount of water needed at high speed, a filtration area must be made large, a filter large-sized-izes, and an installation in the narrow location becomes difficult.

[0004] Moreover, in the filter using the conventional sand stratum, a lot of water was needed in the back-wash process for washing the suspended solid adhering to the filter medium, and great energy was needed for the back wash.

[0005] Then, this applicant has already proposed the filter which can perform an efficient water purification that the above-mentioned fault should be canceled while a miniaturization of equipment can be attained, and can perform processing at the time of a back wash simple and quickly further (application-for-a-utility-model-patent reference [ of No. 57242 / Showa five to ]; October 22, Heisei 5 application).

[0006] If this filter is explained briefly, the filter medium (fiber filter medium) consists of making a thermoplastic staple fiber into the shape of flux, carrying out weld fixation of a part of fiber on this front face of flux, and internal fiber, considering as the shape of a string, cutting this suitably further in a part, and fabricating in the shape of a short column. And this filter makes main components the point of having \*\*\*\*ed the aggregate (filter-medium layer) which made the filter medium dense to the interior.

[0007] According to the above-mentioned configuration, it is enabled to purify the quality of a suspended solid efficiently by having considered the filter medium itself as the above-mentioned configuration. Moreover, since this filter medium is gathered densely and the filter-medium layer is constituted, high-speed filtration is attained, and a miniaturization of equipment can be attained. Moreover, since the specific gravity of a filter medium is light at the time of a back wash, if the compressed air is supplied from the lower part, a filter medium will distribute underwater and separation elimination of the quality of a suspended solid accumulated in the filter medium will be attained by making back-wash water flow in this status. Therefore, processing at the time of a back wash can be performed simple and quickly.

[0008]

[Object of the Invention] According to the configuration mentioned above, although a water purification more efficient than the former etc. can be performed, there is a request of wanting to

make washing of a fiber filter medium highly precise further. That is, it is hard to remove the dirt which entered the interior of a fiber filter medium essentially, and when the dirt with especially viscosity has entered the interior of a fiber filter medium, elimination of dirt will become much more difficult.

[0009] It is the purpose that this invention acquires the washing technique of the filter medium used for the high-speed filter and this which can wash a fiber filter medium with high precision in consideration of the above-mentioned fact.

[0010]

[The means for solving a technical problem] The high-speed filter concerning invention of claim 1 publication Tank-like the mainframe of equipment, The 1st passage which is connected to the upper part of this mainframe of equipment, and supplies non-\*\*\*\*, and the filter-medium layer prepared by being arranged at the pars intermedia of the mainframe of equipment, and making it densely filled up with a fiber filter medium, The 2nd passage which conducts water at the time of a back wash while the treated water which was connected to the lower part of the mainframe of equipment, and was filtered by the filter-medium layer is discharged, It is the high-speed filter constituted including the 3rd passage which discharges the back-wash water which conducted water by this 2nd passage to the equipment book outside of the body at the time of a back wash, and is characterized by what the ultrasonic oscillation means was prepared for in the periphery of a filter-medium layer.

[0011] The high-speed filter concerning invention of claim 2 publication is further characterized by what a stirring means to make the fiber filter medium of the aforementioned filter-medium layer which is the component of a filter-medium layer by air etc. caudad stir was established for in this invention of claim 1 publication.

[0012] By making it densely filled up with a fiber filter medium, the washing technique of the filter medium used for the high-speed filter concerning this invention of claim 3 publication makes a ultrasonic wave irradiate the filter-medium layer prepared in the tank-like mainframe of equipment, and is characterized by having the 1st process which makes dirt exfoliate from a fiber filter medium, and the 2nd process which washes a fiber filter medium by performing aeration and a back wash.

[0013] The washing technique of the filter medium used for the high-speed filter concerning this invention of claim 4 publication The 1st process which air etc. is sprayed [ process ] from the lower part of the filter-medium layer prepared in the tank-like mainframe of equipment by making it densely filled up with a fiber filter medium, and makes a fiber filter medium stir, A ultrasonic wave is made to irradiate the stirred fiber filter medium, and it is characterized by having the 2nd process which makes dirt exfoliate from a fiber filter medium, and the 3rd process which washes a fiber filter medium by the back wash.

[0014]

[Operation] According to this invention of claim 1 publication, non-\*\*\*\* is supplied from the 1st passage connected to the upper part of tank-like the mainframe of equipment. Supplied non-\*\*\*\* is filtered by the filter-medium layer arranged at the pars intermedia of the mainframe of equipment. In addition, since this filter-medium layer is prepared by making it densely filled up with a fiber filter medium, the high-speed filtration of non-\*\*\*\* of it is attained. The treated water filtered by the filter-medium layer is discharged by the 2nd passage connected to the lower part of the mainframe of equipment.

[0015] On the other hand, in washing the fiber filter medium which is the component of a filter-medium layer, it conducts water into the mainframe of equipment from the 2nd passage. A fiber filter medium is washed by this water that conducted water. Since the ultrasonic oscillation means was prepared in the periphery of a filter-medium layer by this invention at this time, the dirt (viscous high dirt is also included) which adhered to the fiber filter medium according to the oscillated ultrasonic wave exfoliates from a fiber filter medium. Thereby, a fiber filter medium is washed with high precision. In addition, the back-wash water after washing is discharged from the 3rd passage to the equipment book outside of the body.

[0016] It compares, when a fiber filter medium exfoliates dirt ultrasonically in the status that it

filled up densely, since a stirring means to make the fiber filter medium which is the component of a filter-medium layer stir by air etc. underneath the filter-medium layer further is established in this invention of claim 1 publication according to this invention of claim 2 publication, and it becomes possible to make dirt exfoliate much more efficiently.

[0017] According to this invention of claim 3 publication, a ultrasonic wave is irradiated according to the 1st process by the filter-medium layer prepared in the tank-like mainframe of equipment. In addition, this filter-medium layer makes it densely filled up with a fiber filter medium. Thereby, the dirt (viscous high dirt is also included) adhering to the fiber filter medium exfoliates from a fiber filter medium. Subsequently, aeration and a back wash are performed by the 2nd process. Thereby, a fiber filter medium is washed. Therefore, according to this invention, a fiber filter medium is washed with high precision.

[0018] According to this invention of claim 4 publication, air etc. is sprayed from the lower part of the filter-medium layer prepared in the tank-like mainframe of equipment, and a fiber filter medium is stirred by the 1st process. In addition, this filter-medium layer makes it densely filled up with a fiber filter medium. Thereby, a fiber filter medium is released from the status that it filled up densely, and will be in the status that it floats alone. Subsequently, a ultrasonic wave is irradiated by the stirred fiber filter medium according to the 2nd process. Thereby, dirt (viscous high dirt is also included) exfoliates from the fiber filter medium in the suspension status. Subsequently, a back wash is carried out by the 3rd process and a fiber filter medium is washed. Therefore, since dirt is made to exfoliate ultrasonically after stirring a fiber filter medium according to this invention, washing of a fiber filter medium becomes highly precise much more.

[0019]

[Example] Drawing 1 - drawing 4 are used for below, and one example of this invention is explained to it.

[0020] The whole high-speed filter 10 configuration is roughly shown in drawing 1, and the outline configuration of the high-speed filter 10 is shown to drawing 2 by the perspective diagram. As shown in these drawings, the high-speed filter 10 is equipped with the tank 12 by which ring-like flange 12A was prepared in the shape of a closed-end cylindrical shape, and the upper-limit circumference section. In addition, the lower part of a tank 12 is supported by two or more braces 14.

[0021] The lid 16 of an approximate circle plate configuration is laid in a part for opening of a tank 12. Ring-like flange 16A is prepared in the soffit circumference section of a lid 16, and it is concluded with the bolt which is not illustrated after having been stuck by flange 12A of the tank 12 mentioned above. Thereby, the closedown of the part for opening of a tank 12 is carried out.

[0022] The non-\*\*\*\* delivery pipe 18 has penetrated among the up peripheral-wall section of the tank 12 mentioned above. This non-\*\*\*\* delivery pipe 18 is crooked upwards inside the tank, and VCF 20 the product made from a wire gauze and cylindrical is further attached in this incursion edge (namely, delivery). \*\* arrival of the apical plate 22 made from disc-like and stainless steel is carried out to the upper-limit section of this VCF 20. Water, such as an artificial pond, is supplied to the interior of a tank 12 with the non-\*\*\*\* delivery pipe 18 mentioned above, and coarse dust is removed by VCF 20 in this case.

[0023] Moreover, the filter-medium layer 24 is arranged at the pars intermedia of a tank 12. This filter-medium layer 24 is constituted by being filled up with many short-column-like fiber filter mediums 26 as shown in drawing 3. If it explains still in detail about this fiber filter medium 26, the fiber filter medium 26 is formed by making a thermoplastic staple fiber into the shape of flux, carrying out weld fixation of a part of fiber on this front face of flux, and internal fiber, cutting the shape of a string, nothing, and this by the length suitably, and fabricating in the shape of a short column. More specifically, by this example, the usual polyester fiber with a length of 76mm was mixed with the polyester hollow fiber with a length of 102mm at a rate of 1:1 by 4d (denier) at 3d, the card sliver was formed, it let the 130-degree C pipe heater pass after remaining heat by infrared radiation, heat weld between fiber and of the sliver front face was carried out, and cooling solidification of the fiber flux with a diameter of 6mm was fabricated and carried out. A cutter cuts this fiber flux in length of 6mm, and it considers as the fiber filter medium 26 of the \*\*\*\*

cylindrical shape shown in drawing 3. the fiber specific gravity of the obtained fiber filter medium 26 -- 1.38 and a bulky density -- 68kg/m<sup>3</sup> it was.

[0024] In addition, although polyester was used as a material of a thermoplastic staple fiber in this example, not only this but a poly\*\*\*\*\* pyrene, a polyamide, polyvinyl alcohol, a poly-acrylic, etc. may be used, these may be used further independently, and two or more sorts of fiber may be mixed and used. Moreover, a staple fiber may be a hollow fiber even if it is a usual fiber configuration, and it may be deformation fiber which has a crack etc. on a fiber front face further. If it adds, since a surface area becomes large and elimination of the fine quality of a suspended solid can perform effectively deformation fiber and the hollow fiber which have irregularity on a fiber front face, they are desirable. Furthermore, the cross-section configuration of the fiber filter medium 26 may not necessarily be circular, for example, the shape of a polygon, a star type, and a petal etc. has, and flux may be hollow further. Moreover, it is not necessary to necessarily cut at right angles to a grain direction, and also about the disconnection orientation which cuts those flux-like fiber aggregates, you may be the orientation of slant and the cut surface may be making not a flat surface but irregularity.

[0025] Here, the measurement result of the elimination factor of the quality of a suspended solid at the time of changing the size of the cylindrical fiber filter medium 26 is shown in Table 1. In addition, what passed 0.42mm mesh for Okinawa red clay after xeransis at 110 degrees C as quality of a suspended solid was used. Moreover, the transparency rate of flow filtered as 50m/h.

[0026]

[Table 1]

ろ過材形状 (円柱形)		原水浮遊 固体物質濃度	処理水浮遊 固体物質濃度	浮遊固体物質 除去率
直径 (mm)	長さ (mm)	(mg/L)	(mg/L)	(%)
12	12	2.7	1.0	63
		7.2	2.8	61
6	6	3.3	0.8	76
		6.8	1.5	78
3	3	3.8	0.4	89
		7.8	0.8	90

透過流速 : 50m/h

[0027] As shown in Table 1, when the configuration was a cylindrical shape like the fiber filter medium 26, the small fiber filter medium of the elimination factor of the quality of a suspended solid was higher irrespective of the content of the quality of a suspended solid. That is, from the viewpoint of the elimination luminous efficacy of the quality of a suspended solid, the diameter of about 2 - about 10mm of abbreviation is desirable, and about 3 - about 6mm of abbreviation are desirable especially. It becomes [ at the time of a back wash ] easy to be spilt out and is not desirable if filtration luminous efficacy will get worse if a diameter exceeds 10mm, and it is less than 2mm. Moreover, similarly, about 2 - 10mm of a length of abbreviation are desirable, and about 3 - its about 6mm of abbreviation are especially desirable.

[0028] It returns to drawing 1 and the gravel stratum 28 prepared by being filled up with ballast is formed underneath the filter-medium layer 24 mentioned above. In addition, the gravel stratum 28 is supported by the disc-like perforated plate 30 arranged at the lower part of a tank 12. The air supply system is laid under this gravel stratum 28. That is, the air delivery pipe 32 has penetrated among the lower peripheral-wall section of a tank 12. This air delivery pipe 32 is crooked below inside the tank, and the aeration spool 34 which is a rectangle spool is further connected to this incursion edge (namely, delivery) in parallel with the air delivery pipe 32. Two or more branch pipes 36 in a predetermined spacing are \*\*\*\*ed in the state of \*\*\*\* by the both-sides wall of this

aeration spool 34. In addition, each branch pipe 36 is made into the shape of a pipe, and contiguity arrangement of the point is carried out at tank inner skin. Along with the longitudinal direction, two or more fresh air inlets (illustration ellipsis) are formed in the lower part of this branch pipe 36.

[0029] Furthermore, treated-water drainage and the back-wash water delivery pipe 38 equipped with the flow control valve are connected in the center of the pars basilaris ossis occipitalis of a tank 12. Although it is used in order that this treated-water drainage and back-wash water delivery pipe 38 may re-supply the clear treated water which penetrated the filter-medium layer 24 mentioned above to an artificial pond etc., at the time of a back wash, back-wash water is supplied in a tank 12 using this treated-water drainage and back-wash water delivery pipe 38. Moreover, the back-wash water issue pipe 40 \*\*\*\*ed with the exterior is connected to the lid 16 that back-wash water should be discharged out of a tank 12.

[0030] The above is the whole high-speed filter 10 configuration concerning this example, and explains the configuration of the principal part of this example below.

[0031] As shown in drawing 1, in this example, two or more ultrasonic wave oscillators 42 are \*\*\*\*ed by the predetermined periphery section (site equivalent to the periphery section of the filter-medium layer 24 mentioned above) of a tank 12. Thereby, the field which can be cleaned ultrasonically is obtained in the domain of the drawing 4 illustration. In addition, the frequency of a ultrasonic wave is set as 10-100kHz.

[0032] Next, an operation of this example is explained. When filtering water, such as a usual artificial pond, as shown to drawing 1 by the solid-line arrow head, non-\*\*\*\* is supplied in a tank 12 from the non-\*\*\*\* delivery pipe 18. Thereby, non-\*\*\*\* passes along VCF 20 and coarse dust is removed in this case. The water which watered the upper part of a tank 12 from VCF 20 penetrates the filter-medium layer 24 and the gravel stratum 28 according to the water head difference, after piling up in the upper layer of the filter-medium layer 24. The underwater quality of a suspended solid is filtered and removed in this process. Especially, in this example, it is filtered with an efficiently and sufficient precision from constituting the filter-medium layer 24 by many fiber filter mediums 26. The filtered clear treated water is discharged from the lower part of a tank 12 through a perforated plate 30 through treated-water drainage and the back-wash water delivery pipe 38. Thereby, a clear treated water is again returned to an artificial pond etc.

[0033] On the other hand, while repeating the filtration process mentioned above, dirt adheres to the front face and the interior of the fiber filter medium 26. The viscous high thing is also contained in this dirt. In this case, the fiber filter medium 26 is washed by the following points.

[0034] First, a ultrasonic wave is oscillated from a ultrasonic wave oscillator 42 in the state of the drawing 1 illustration. Thereby, the dirt adhering to the front face of the fiber filter medium 26 of the filter-medium layer 24 etc. exfoliates from the fiber filter medium 26. Then, as shown to drawing 4 by the dashed line, air is supplied to the lower part of a tank 12. That is, by making a compressor drive, air is supplied to the aeration spool 34 from the air delivery pipe 32, and air is further supplied to two or more branch pipes 36 from the aeration spool 34. This air blows off from the fresh air inlet of each branch pipe 36 in the lower part of a tank 12. Consequently, while the fiber filter medium 26 with light specific gravity is stirred and stirred by the stream (two-dot-chain-line arrow head of drawing 4) produced by air, continuation implementation of the ultrasonic cleaning is carried out. Thereby, the dirt adhering to the front face and the interior of the fiber filter medium 26 exfoliates further. Then, as water, such as an artificial pond, is shown by the dashed-line arrow head of drawing 1 as back-wash water, the lower part of a tank 12 is supplied from treated-water drainage and the back-wash water delivery pipe 38. Thereby, stirring is promoted much more and the cleaning effect of the fiber filter medium 26 is raised. In addition, a ultrasonic wave is oscillated from a ultrasonic wave oscillator 42 in this case. Thus, if the washing process of the fiber filter medium 26 ends, it will be discharged from the back-wash water issue pipe 40 in the exterior of the high-speed filter 10.

[0035] In addition, after washing of the fiber filter medium 26 by aeration and the back wash, the stirred fiber filter medium 26 sediments and forms the filter-medium layer 24 again. If some drainage is performed from treated-water drainage and the back-wash water delivery pipe 38 at

this time, the water pressure in that case will be densely filled up with the fiber filter medium 26. [0036] In this example, a thermoplastic staple fiber is made into the shape of flux, and weld fixation of a part of fiber on this front face of flux and internal fiber is carried out. Thus, nothing [the shape of a string and nothing], Since the ultrasonic wave oscillator 42 for exfoliating the dirt which formed the filter-medium layer 24 and adhered to the periphery at the fiber filter medium 26 by being densely filled up with the fiber filter medium 26 prepared by cutting this by the length suitably and fabricating in the shape of a short column was \*\*\*\*ed The fiber filter medium 26 can be washed with high precision.

[0037] And in this example, since it is the configuration of performing ultrasonic cleaning, making it stir, washing precision can be raised rather than the case where it cleans ultrasonically in the state of restoration. Moreover, thereby, curtailment of the \*\*\* number of a ultrasonic wave oscillator 42 can also be aimed at.

[0038] In addition, although it began to irradiate a ultrasonic wave at this example in the drawing 1 illustration status, i.e., the status that it filled up with the fiber filter medium 26, after making not only this but the fiber filter medium 26 stir, you may be made to irradiate a ultrasonic wave.

[0039] Moreover, although a thermoplastic staple fiber is made into the shape of flux, weld fixation of a part of fiber on this front face of flux and internal fiber is carried out and the fiber filter medium 26 is constituted from this example, you may make it the configuration pasted up not only with this but with a binder etc. Furthermore, a staple fiber may be put in small containers, such as a \*\*\* type, the fiber filter medium 26 may be constituted, and all are applicable if it is the fiber filter medium 26.

[0040] Furthermore, at this example, although the gravel stratum 28 is \*\*\*\*ed in the lower part of the filter-medium layer 24, this gravel stratum 28 can also be omitted by the case rather than is necessarily required.

[0041]

[Effect of the invention] As explained above, the washing technique of the filter medium used for the high-speed filter and this concerning this invention has the outstanding effect that a fiber filter medium can be washed with high precision.

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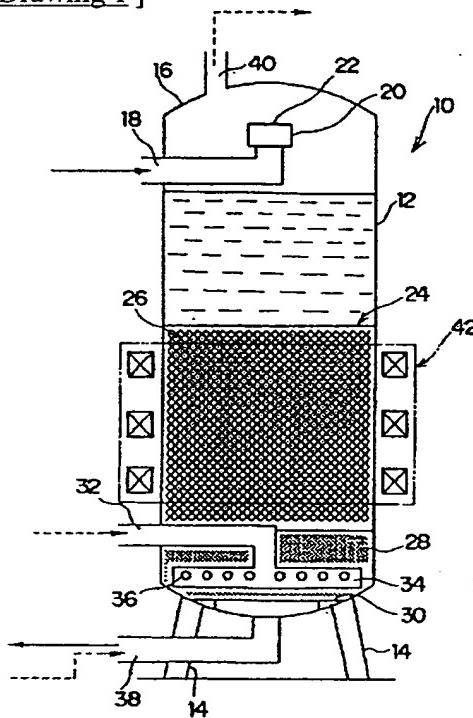
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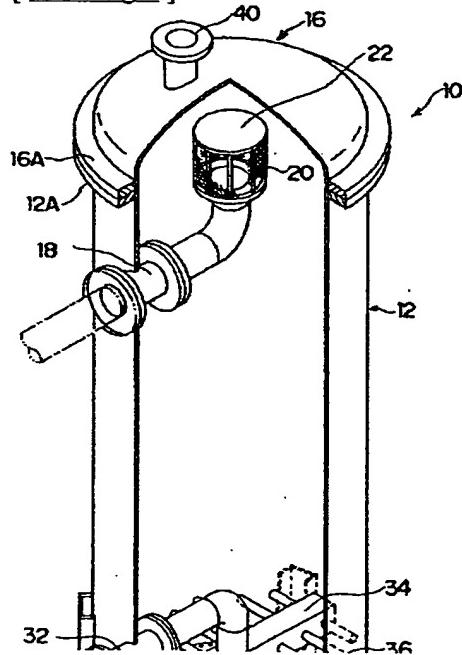
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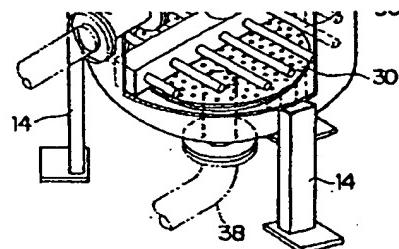
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[ Drawing 1 ]



[ Drawing 2 ]

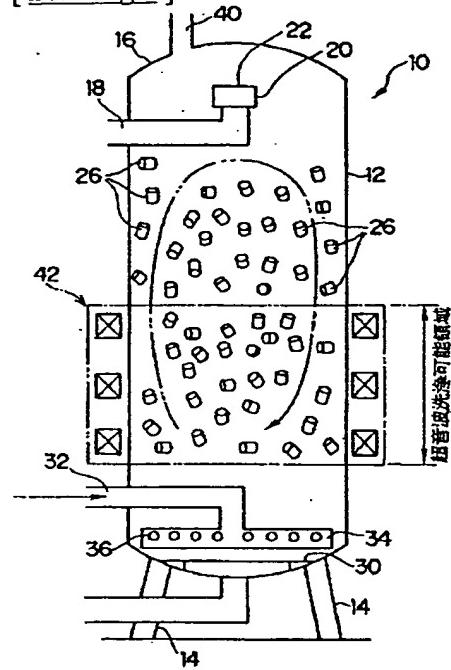




[ Drawing 3 ]



[ Drawing 4 ]



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